

Identification of success factors for the implementation of knowledge management using the Malcolm Baldrige Excellence Model in one of the Iranian petrochemical companies

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Abstract

In the knowledge era, competitive strength is subject to acquisition and development of individual and organizational knowledge. A successful implementation of knowledge management can help producing appropriate knowledge, in appropriate time and for the appropriate person, along the organizational strategy. Additionally, it can help the organizational competitive advantage. The main purpose of this research is to identify success factors in knowledge management implementation in one of the Iranian petrochemical companies with regards to Malcolm Baldrige Excellence Model approach. The influence of each factor has also been calculated. For this purpose, data were gathered through two kinds of questionnaire. Validity of the questionnaires has been confirmed by academicians and experts of this field. Reliability of knowledge management maturity level assessment questionnaire and Malcolm Baldrige criteria questionnaire have been evaluated by Cronbach's Alpha coefficients. The coefficients have been obtained as equal to 0.972 and 0.955, respectively. In the first stage of the research methodology, the normality of data was tested by Kolmogorov-Smirnov test, and then the results were confirmed by correlation and regression analysis at the confidence level of 99 percent. As a consequence, the more effective success factors in knowledge management implementation were identified and presented according to Malcolm Baldrige Excellence model criteria which order of importance is as follows: business results, process management, work force focus, measurement and analysis and knowledge management, leadership, strategic planning and customer focus. In addition, obtained results show that there is no significant relationship between personal features and successful implementation of knowledge management.

Keywords: knowledge management, Malcolm Baldrige National Quality Award, Quality Excellence Model, petrochemical companies

1. Introduction

Knowledge has been recognized as an important source of competitive advantage and value creation (King and Zeithaml, 2003; Massa and Testa, 2009). Moreover, knowledge that firms acquire is a dynamic resource that needs to be nourished and managed carefully (Farzin et al., 2013). As Campos (2009) indicates, we are in the

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era of knowledge, in which this resource is the most important productive factor that organizations must manage. Their survival depends, to a large extent, on the knowledge that they possess and their ability to generate, retain, transfer and operate the capabilities of people; that is, to manage knowledge.

Organizations implement knowledge management (KM) to improve efficiency and to provide effective ways of using their intellectual assets. KM is no longer an option but rather a necessity for organizations anywhere in the world (Akhavan et al., 2010).

In recent years, so many large companies have put the knowledge management implementation on their agenda. Assessing the maturity level of the knowledge, they apply the knowledge management process in order to improve knowledge maturity in their organization and as a result, they can improve the efficiency of all fields, significantly. However, some organizations have failure experiences in the implementation of KM and those are due to not being able to identify the success factors of KM implementation.

On the other hand, going through the path of excellence is one of the main objectives of every organization. Therefore, following the organizational excellence models could be paving the way for them to achieve sustainable success. Bou-Llusar et al. (2009) and Calvo-Mora et al. (2014) point out how the use of the excellence model guarantees that the management practices employed, form a coherent system. Excellence models, which aimed at measuring the performance of organizations will contribute to a comprehensive approach to all aspects and all its stakeholders, and careful evaluation of their performance. Knowledge management is a perfect tool for creating, refining, storage, sharing and dissemination of knowledge in a systematic and integrated way in the organization, which is one of the requirements of excellence models and mutually these models are a perfect platform for the implementation of KM (Safaie and Ghanavati Nezhad, 2014).

Since the development of the petrochemical industry is one of the key success factors of the country's economic and political dimensions, both internally and internationally, doing research for the identification of positive structures and also barriers and challenges of the implementation of KM in petrochemical and oil products industries, is of great importance. Hence, this study is to identify the effective factors contributing to the successful implementation of KM using the Malcolm Baldrige Excellence model in one of the Iranian petrochemical companies.

2. Literature review

Today, management based on knowledge consists of a wide range of management activities and exchange, creation or enhancement of intellectual capital at the macro organizational level. In order to answer the important question of why some organizations are successful in competition and what makes some organizations experience failure, it requires a correct understanding of critical role of organizational knowledge. Therefore, managers of organizations have recognized that machinery, equipment and buildings are not the organization's most important assets anymore, but is the organizational knowledge and its efficient management which can lead to organizational competitive advantage.

In recent years, many researchers have tried to identify critical success factors of KM in order to be able to plan and capitalize on those factors that would finally lead to achieving their organizational goals. Ranjan and Bhatnagar (2008) advocate that CSFs are the crucial factors or parameters required for ensuring the continued success of an organization and these factors represent those managerial areas that must be given special and continual attention to cause high performance.

Table 1 shows a number of factors presented in previous studies as success factors of KM implementation.

Table 1. The CSFs for the KM implementation presented in previous studies

Researchers	Year of Research	Critical Success Factors
Davenport, T. H. and Prusak, L.	1998	The value of Industry, Common language and purpose, Flexible and standardized structure of knowledge, Multiple channels for knowledge transfer, Knowledge-friendly culture, Organizational and technical infrastructure, Incentive measures and support from senior management
Liebowitz, J.	1999	Top management support for knowledge management strategy, Senior knowledge manager or equivalent and knowledge management infrastructure, Typology of knowledge, Knowledge repositories, Knowledge management systems, Knowledge sharing incentives.
Holsapple, C. W. and Singh, M.	2001	Environmental factors such as competition, technology, time, economic and political and governmental conditions.
Hsieh, C. and Chen, K. L.	2003	Employee motivation, Organizational culture, Top management support, Rewards for knowledge sharing, Efficient data mining and information technology.
Lindner, F. and Wald, A.	2010	Controlling of KM activities, Processes project knowledge, Mistake tolerance, Informal networks, Institutionalization multi-project management, ICT support, Management commitment, Organization PK, Maturity PM-methodology, Project culture, PKM-effectiveness, Systems communication, Systems storage, Knowledge culture
Valmohammadi, C.	2010	Top management supports, Organizational culture, Technological infrastructure, Knowledge management strategy, Performance measurement, Organizational infrastructure, Processes and activities, Rewards and incentives, Resource constraints, Education and training, Human resource management and Benchmarking.
Kahre, M. S.	2011	Organizational alignment and articulates explicitly its purpose, visions and values consistent with responsible business, Information provision, Knowledge sharing, Cooperation, Legal norms, Organizational ambiguity, Employee volunteering, Corporate Social Responsibility (CSR), Community involvement in corporate decision making, Organizational trust, The involvement of the board of directors, Inspirational leadership, Organizational commitment, Social norms and the impact of community factors, Organizational culture, Job satisfaction, Job enrichment, Job enlargement, Competitive orientation of the organization, Organizational citizenship behavior, Formal strategic planning, High level of communication in the organization, Organizational orientation for the domestic competition, Organizational orientation for the environmental competition.

The literature contributes evidence of relationships between quality management and KM practices. These relationships have been analyzed taking as reference the ISO 9000 family of standards (Tang and Tong, 2007; Lin and Wu, 2005).

KM and Total Quality Management (TQM) are complementary. A synergistic combination of KM and TQM forms a cycle of improvement and development, leading to organizational excellence.

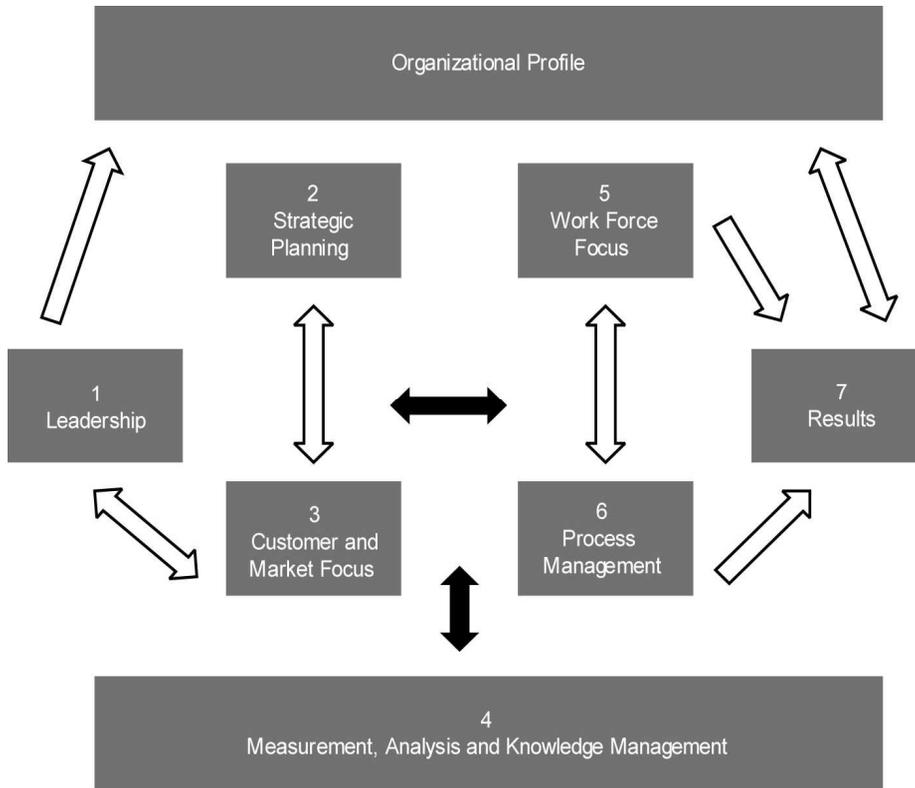
TQM is a comprehensive management philosophy oriented towards achieving excellent results in relation

to stakeholders (Prajogo and McDermott, 2005). Different frameworks exist to implement the principles and practices of TQM. Yusof and Aspinwall (2000) indicated that one of these frameworks is the excellence models or quality awards. One of these quality awards is Malcolm Baldrige National Quality Award- MBNQA.

The Malcolm Baldrige National Quality Award (MBNQA) was established in 1987 by the US Congress to recognize American organizations for superlative performance and quality in seven areas: 1) leadership, 2) strategic planning, 3) customer and market focus, 4) measurement, analysis and knowledge management, 5) work force focus, 6) process management, and 7) results. The MBNQA is updated yearly; the revised criteria are posted on the National Institute for Standards website (<http://www.nist.gov>). However, since its creation, the core criteria have remained constant at global level.

Because of its prominence as a quality assessment tool, the MBNQA has attracted the attention of researchers and its criteria are validated by several published studies (Prybutok et al., 2010). Figure.1 shows a systems perspective of 2010 MBNQA criteria for performance excellence framework.

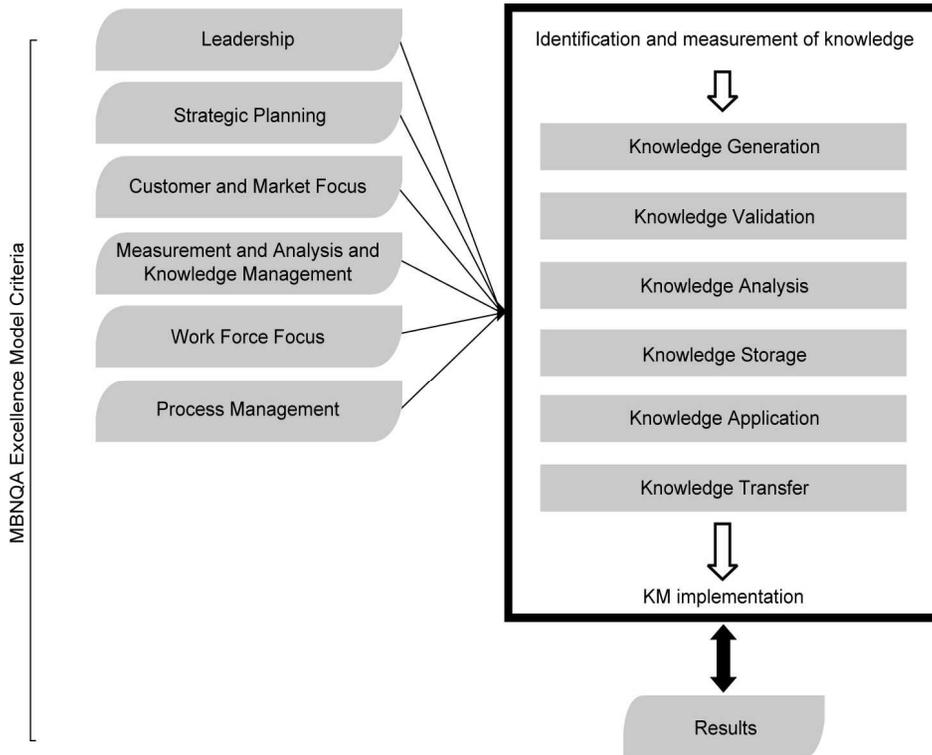
Figure 1. A systems perspective of 2010 MBNQA criteria for performance excellence framework



As mentioned previously in this study, different researchers have identified different classifications for the success factors in the implementation of KM and the results of any previous research are considerable.

However, there is a lack research that empirically identifies and prioritizes the factors of success using Malcolm Baldrige Excellence model as a reference framework for KM implementation. For that reason the present study focuses on identification of the success factors of the implementation of KM using the MBNQA.

Figure 2. Research conceptual model



3. Research methodology

The objective of this study is to identify and assess the factors affecting KM in the petrochemical companies in Iran according to MBNQA. The research assesses the factors and variables via a qualitative field study using three types of questionnaire filled out by a sample of 290 randomly selected knowledge workers including managers and staff in the studied petrochemical company. The research uses one designed questionnaire based on the individual features and two standard questionnaires associated with the knowledge management maturity level assessment and MBNQA Excellence model criteria. The qualitative data are analyzed using the content analysis. The items are measured on a five-point (1-5) Likert scale, in which 5 indicates that the respondents strongly agree with the statement and 1 indicates that the respondents strongly disagree with the statement, respectively. Validity of the questionnaires have been confirmed by academicians and experts of this field. Reliability of KM maturity level assessment questionnaire and MBNQA Excellence model criteria questionnaire have been evaluated by Cronbach's Alpha coefficients and its results are provided in Table 2 and Table 3.

Table 2. Cronbach's Alpha coefficients associated with the KM maturity level assessment questionnaire

Indicators of KM maturity level assessments	Number of questions	Cronbach's Alpha coefficient
Knowledge management leadership	6	0.844
Processes	6	0.843
Staff	6	0.814
Technology	6	0.793
Knowledge processes	6	0.848
Learning and innovation	6	0.843
Knowledge management results	6	0.847
Total knowledge management implementation	42	0.972

Table 3. Cronbach's Alpha Coefficients associated with the MBNQA Excellence model criteria questionnaire

MBNQA criteria	Number of questions	Cronbach's Alpha coefficient
Leadership	3	0.806
Strategic planning	5	0.792
Customer and market focus	7	0.728
Measurement, analysis and knowledge management	7	0.826
Work force focus	6	0.882
Process management	7	0.817
Total MBNQA criteria results	35	0.955

As all indicators' Cronbach's alpha coefficients are greater than 0.75, it can be concluded that KM maturity level assessment questionnaire and the MBNQA Excellence model criteria questionnaire are of acceptable reliability.

The subjects of the main survey included staff and managers of the studied petrochemical company which have been working in the mentioned company between 2014 and 2016 and the number of them is equal to 1178 people. Cochran's sample size formula has been used in order to determine the appropriate sample size of the research.

Formula 1. Cochran's sample size formula

$$n = \frac{\frac{z^2 pq}{4d^2}}{1 + \frac{1}{N} \left(\frac{z^2 pq}{4d^2} - 1 \right)}$$

Which is valid where n is the sample size, N is the population size, z^2 is the abscissa of the normal curve that cuts off an area α at the tails ($1-\alpha$ equals to the desired confidence level, $z=1.96$ for 95% confidence level), p is the proportion of an attribute that is present in the population, q is $1-p$ and d is the acceptable margin of error for proportion being estimated.

According to the results shown in the previous tables, as the significance level for all components is greater than 0.05, the normality of these variables is confirmed.

In order to survey the relationship between KM implementation and MBNQA Excellence model criteria and to investigate research hypotheses, the Pearson correlation coefficient is used. Therefore we propose the following hypotheses:

- . H₀: There is no significant relationship between the leadership criterion and the successful KM implementation.
- . H₁: There is a significant relationship between the leadership criterion and the successful KM implementation.

- . H₀: There is no significant relationship between the strategic planning criterion and the successful KM implementation.
- . H₁: There is a significant relationship between the strategic planning criterion and the successful KM implementation.

- . H₀: There is no significant relationship between the customer and market focus criterion and the successful KM implementation.
- . H₁: There is a significant relationship between the customer and market focus criterion and the successful KM implementation.

- . H₀: There is no significant relationship between the measurement, analysis and knowledge management criterion and the successful KM implementation.
- . H₁: There is a significant relationship between the measurement, analysis and knowledge management criterion and the successful KM implementation.

- . H₀: There is no significant relationship between the work force focus criterion and the successful KM implementation.
- . H₁: There is a significant relationship between the work force focus criterion and the successful KM implementation.

- . H₀: There is no significant relationship between the process management criterion and the successful KM implementation.
- . H₁: There is a significant relationship between the process management criterion and the successful KM implementation.

- . H₀: There is no significant relationship between the results criterion and the successful KM implementation.
- . H₁: There is a significant relationship between the results criterion and the successful KM implementation.

Pearson correlation test results and thereby confirmation or rejection of the hypotheses are presented in Table 6.

Table 6. The Pearson correlation test results

MBNQA criteria	Correlation coefficient	Significance level	Confirmation/Rejection of significant relationship between the MBNQA criterion and successful implementation of knowledge management
Leadership	0.725	0.000	Confirmed
Strategic planning	0.68	0.000	Confirmed
Customer and market focus	0.661	0.000	Confirmed
Measurement, analysis and knowledge management	0.757	0.000	Confirmed
Work force focus	0.762	0.000	Confirmed
Process management	0.763	0.000	Confirmed
MBNQA Criteria results	0.849	0.000	Confirmed

In the present study, in order to investigate the relationship between independent variables (MBNQA criteria) and the dependent variable (implementation of KM), a simple linear regression analysis is used. The regression models between various criteria of the MBNQA Excellence model and successful KM implementation are also presented.

Table 7, Table 8 and Table 9 contain the data associated with regression model between the leadership and the successful KM implementation.

Table 7. Durbin-Watson and correlation coefficient values

Durbin-Watson	Error deviation	Adjusted coefficient of determination	Coefficient of determination	Correlation coefficient
1.968	0.586	0.524	0.526	0.725

Table 8. Analysis of variance of regression model between leadership criterion and KM implementation.

Source	Sum of squares	Degree of freedom	Mean square	F	p
Regression model	109.905	1	109.905	319.063	0.000
Error	99.205	288	0.344		
total	209.11	289			

Table 9. Results of assessing significance of regression coefficients

Model	B	Standard error	Beta	t	significance level
Constant	1.308	0.101		12.959	0.000
Leadership	0.568	0.032	0.725	17.862	0.000

Dependent variable: KM implementation

Using the obtained results, the regression equation is presented as follows:

$$\text{KM implementation} = 1.308 + (0.568) * \text{Leadership criterion}$$

Figure 3 and Figure 4. illustrate the histogram of frequency and standardized residual and normal p-p plot of regression standardized residual associated with the regression model between leadership criterion and KM implementation, respectively.

Figure 3. Histogram of frequency and standardized residual

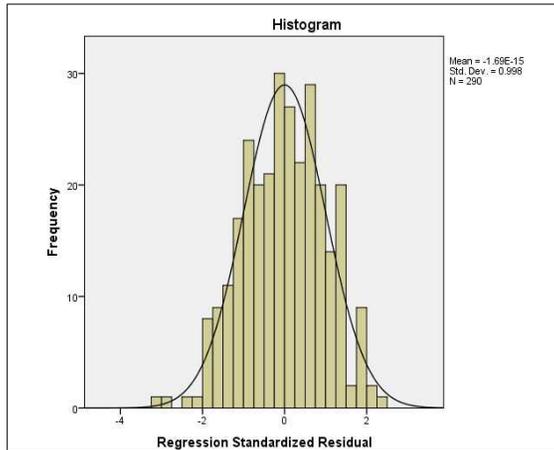
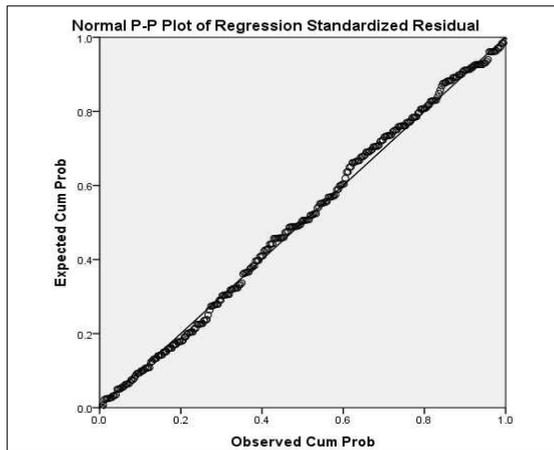


Figure 4. Normal p-p plot of regression standardized residual



It can be shown that other criteria have the same plot as the leadership criterion plot. In order to investigate the relationship between other MBNQA Excellence model criteria and KM implementation, the same analytical process has been applied for MBNQA Excellence model criteria and the obtained regression equations are shown in Table 10.

Table 10. Obtained regression equations between MBNQA Excellence model criteria and KM implementation

MBNQA Excellence model criteria	Obtained regression equation
Strategic planning	KM implementation= 1.174+ (0.623)* Strategic planning criterion
Customer and market focus	KM implementation= 1.231+ (0.610)* Customer and market focus criterion
Measurement, analysis and knowledge management	KM implementation= 1.029+ (0.659)* Measurement, analysis and KM criterion
Work force focus	KM implementation= 0.843+ (0.724)* Work force focus criterion
Process management	KM implementation= 0.975+ (0.679)* Process management criterion
Results	KM implementation= 0.393+ (0.881)* Results criterion

In addition to the research hypotheses, the relationship between a number of personal features of employees and a successful KM implementation is investigated using the Spearman's rank correlation and the results are presented in Table 11.

Table 11. Spearman's rank correlation results

		Gender	Age	Marital status	Education	Work experience	Type of occupation
Successful implementation of knowledge management	Spearman correlation	-0.07	0.73	0.012	0.014	0.08	-0.029
	Significance level	0.237	0.299	0.844	0.808	0.176	0.628
	Number	290	290	290	290	290	290

5. Conclusions

This research provides an insight into the critical success factors for the implementation of knowledge management by using MBNQA Excellence model in an Iranian petrochemical company. For that purpose, a sample of 290 people were randomly selected out of the staff working in the studied petrochemical company and responded to the questionnaire survey. This study presents that there is a positive and significant relationship between the criteria of the MBNQA Excellence model and a successful deployment of KM in the petrochemical company. In addition, this study presents the more essential factors which should be taken in to account to put KM into practice successfully and the obtained order of priority is as follows: business results, process management, work force focus, measurement and analysis and knowledge management, leadership, strategic planning and customer focus. In addition, obtained results show that there is no significant relationship between personal features and successful KM implementation.

Regarding the results obtained in this study, company managers could evaluate the status of each identified critical success factor and seek to improve the status of each factor in order to put a successful implementation of knowledge management into account. Moreover, planning in the field of process management and work force and receiving the appropriate feedback at the appropriate time could be an important platform for a successful KM implementation. Providing appropriate technological fields for the purpose of acquiring, sharing and

preservation of knowledge, defining leadership and management tasks, recognition of the gap between existing knowledge and appropriate knowledge and finally creating an environment based on trust for knowledge sharing between individuals are some suggested practical solutions for successful KM implementation in organizations. The results of this research are very useful for both academicians and experts of this field. Future researchers may use the results of this research in order to develop the framework for a successful KM implementation in other industries and also a broader region and in the international setting.

References

- Akhavan, P., Adalati, M., Sharifi-Yazdi, S. and Hosnavi, R. (2010). The challenges of knowledge management portals application and implementation: an Iranian organizations case study. *International Journal of Industrial Engineering Computations*, 1(1), 79-93.
- Bou-Llusar, J. C., Escrig-Tena, A. B., Roca-Puig, V. and Beltrán-Martín, I. (2009). An empirical assessment of the EFQM Excellence Model: evaluation as a TQM framework relative to the MBNQA Model. *Journal of Operations Management*, 27(1), 1-22.
- Calvo-Mora, A., Picon, A., Ruiz, C. and Cauzo, L. (2014). The relationships between soft-hard TQM factors and key business results. *International Journal of Operation and Production Management*, 34(1), 115-143.
- Campos, E. B. (2009). El gobierno o gestión del conocimiento como estrategia de creación de valor. *Cuad. Gestión Conocimiento Empresarial*, 16, 1-5.
- Davenport T. H. and Prusak L. (1998). *Working Knowledge: How Organizations Manage What They Know*. Boston: Harvard Business School Press.
- Farzin, M. R., Kahreh, M. S., Hesani, M. and Khalouei, A. (2014). A survey of critical success factors for strategic knowledge management implementation: applications for service sector. *Procedia-Social and Behavioral Sciences*, 109, 595-599.
- Holsapple, C. W. and Singh, M. (2001). The knowledge chain model: activities for competitiveness. *Expert Systems with Applications*, 20(1), 77-98.
- Hsieh, C. and Chen, K. (2003). Critical success factors for implementing a corporate knowledge management system. Retrieved from <http://www.sbaer.uca.edu/research/2003/swdi/papers> (Accessed April, 27, 2010)
- Kahreh, M. S. (2011). Economics of strategic knowledge management: a new model for assessment. *International Journal of Trade, Economics and Finance*, 2(3), 257-262.
- King, A. W. and Zeithaml, C. P. (2003). Measuring organizational knowledge: a conceptual and methodological framework. *Strategic Management Journal*, 24(8), 763-772.
- Liebowitz, J. (1999). Key ingredients to the success of an organization's knowledge management strategy. *Knowledge and Process Management*, 6(1), 37-40.
- Lin, C. and Wu, C. (2005). A knowledge creation model for ISO 9001:2000. *Total Quality Management & Business Excellence*, 16(5), 657-670.
- Lindner, F. and Wald, A. (2011). Success factors of knowledge management in temporary organizations. *International Journal of Project Management*, 29(7), 877-888.
- Massa, S. and Testa, S. (2009). A knowledge management approach to organizational competitive advantage: evidence from the food sector. *European Management Journal* 27(2), 129-141.
- Prajogo, D. I. and McDermott, C. M. (2005). The relationship between total quality management practices and organizational culture. *International Journal of Operations & Production Management*, 25(11), 1101-1122.
- Prybutok, V., Zhang, X. and Peak, D. (2010). Assessing the effectiveness of the Malcolm Baldrige National Quality Award model with municipal government. *Journal of Socio-Economic Planning Sciences*, 45(3), 118-129.
- Ranjan J, and Bhatnagar V. (2008). Critical success factors for implementing CRM using data mining. *Journal of Knowledge Management Practice*. 9(3), 18-25.
- Safaie, N. and Ghanavati Nezhad, M. (2015). An investigation on the situation of the knowledge management in Iran

- National Quality Award, Comprehensive International Congress on Iran Management.
- Tang, J. and Tong, J. Y. (2007). A two-phase knowledge management system for the quality standard ISO9001. *International Journal of Management*, 24(1), 184-197.
- Valmohammadi, C. (2010). Identification and prioritization of critical success factors of knowledge management in Iranian SMEs: an experts' view. *African Journal of Business Management*, 4(6), 915-924.
- Yusof, S. R. M. and Aspinwall, E. (2000). Total quality management implementation frameworks: comparison and review. *Total Quality Management*, 11(3), 281-294.